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FITZPATRICK CELLA HARPER & SCINTO
30 ROCKEFELLER PLAZA
NEW YORK, NY 10112

EXAMINER	
LUU, CUONG V	

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2128	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	**Application No.** 10/812,868	**Applicant(s)** WASHIZAWA, TERUYOSHI	
	Examiner CUONG V. LUU	**Art Unit** 2128	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _18 September 2008_.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-14_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-14_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claims 1-14 are pending. Claims 1-14 have been examined. Claims 1-14 have been rejected.

Response to Arguments

1. The 35 U.S.C. 112, second paragraph rejections of claims 1, 4, 7, 10, and 13-14 are withdrawn in light of amendments to these claims.

2. Applicant's arguments filed 9/18/2008, see pages 13-16, regarding claims 1, 4, 7, 10, and 13-14 have been fully considered but they are not persuasive. The Applicant argues that the optimality criteria method used in Patnaik does not teach or suggest use of, among other criteria, a nodal force vector P, a global stiffness matrix X, and a nodal displacement vector u, as provided in equation 41 of Adeli and that Patnaik's method would be rendered inoperable if such an equation was used in the manner proposed in the Office Action. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Claims 1, 4, 7, 10, and 13-14 remain rejected.

3. Claims 2-3, 5-6, 8-9, and 11-12 are argued allowable due to depending on claims 1, 4, 7, and 10, respectively. Since claims 1, 4, 7, and 10 remain rejected, claims 2-3, 5-6, 8-9, and 11-12 remain rejected.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-2, 4-5, 7-8, 10-11, and 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Patnaik et al. (Merits and Limitations of Optimality Criteria Method for Structural Optimization, NASA Technical Paper 3373, 1993) in view of Adeli et al. (U.S. Pat. 5,815,394).

4. As per claim 1, Patnaik teaches a method of optimally designing a structure in an area comprising a step of obtaining a solution of a structure optimal designing problem having a first solution process to solve an optimization problem of a first evaluation function for a status variable vector and a design variable vector, wherein the design variable vector is a rate of existence to a structural member in each divided area of the area, and the status variable vector is a displacement in each node of the divided area (p. 1 col. 1 paragraph 2 lines 1-5, p. 9 equation 26 variable F defined on p. 41 equation C6. Patnaik teaches optimally designing structures having a first solution process and a second solution process. Patnaik further discloses the status variable vector being a displacement in each node – definition of variable X from equation 31, listed at bottom left of p. 40 – and the design variable vector being rate of existence ration of a structure member in each element – taught in reference as “density”, see derivation of equation 26 on p. 41 equation C6, where F is defined to be a design variable. A design variable vector is the rate of existence in a structure optimization problem as evidence by the Applicant's specification p.18 lines 2-7),

said first solution process comprising:

a design variable update step of reading the design variable vector and the status variable vector stored in a first storage unit, updating the design variable vector, and storing the updated design variable vector into said first storage unit (p. 9 equation 27, p. 6 equations 21a & 21b & col. 2 second paragraph),

a status variable update step of reading the updated design variable vector and the status variable vector stored in a second storage unit, updating the status variable vector, and storing the updated status variable vector into said second storage unit, said status variable update step including a second solution process to solve an optimization problem of a second evaluation function for the updated status variable vector and the updated design variable vector (p. 9 equation 27 & col. 1 lines 2-5 and p. 7 col. 2 section IIIA), and

a determination step of determining whether the update in said design variable update step and the update in said status variable update step are to be terminated (p. 2 col. 1 last paragraph and col. 2 first paragraph. In these paragraphs Patnaik teaches iteration and update. This teaching implies the determination of whether the update step is to be terminated); and

an output step of outputting an image of the structure corresponding to the design variable vector and the status variable vector after the updates are terminated (p. 7 col. 2 section A. Interface Module second paragraph and p. 11 Fig. 4. In these paragraphs and figure, Patnaik teaches printing out final results and displaying image of a design, so this teaching implies the capability of this limitation), and otherwise returning to said design variable step to update the design variable vector (p. 2 col. 1 last paragraph and col. 2 first paragraph. In these paragraphs Patnaik teaches iteration and update. This teaching implies the determination of whether the update step is to be terminated);

Patnaik, however, does not teach the second evaluation function corresponds to a norm of a residual vector which is obtained as a difference between a nodal force vector and the updated status variable vector on which a global stiffness matrix is operated.

However, Adeli teaches this limitation (col. 18 lines 1-7 & 15-18 & equation 41, col. 16 lines 47-55, col. 24 line 22).

It would have been obvious to one of ordinary skill in the art to combine the teachings of Patnaik and Adeli. Adeli's teachings would have adopted the diagonal preconditioner method in order to accelerate the search process in the conjugate gradient method (col. 17 lines 3- 10).

5. As per claim 2, Patnaik teaches at said first solution process, any one of a sequential linear programming method, an optimality criteria method, and a sequential convex function approximate method is executed (p. 7 section IIIB first paragraph).

6. As per claim 4, Patnaik teaches a method of optimally designing a structure in an area comprising a step of obtaining a solution of a structure optimal designing problem having a first solution process to solve an optimization problem of a first evaluation function for a status variable vector and a design variable vector, wherein the design variable vector is a rate of existence to a structural member in each divided area of the area, and the status variable vector is a displacement in each node of the divided area (p. 1 col. 1 paragraph 2 lines 1-5, p. 9 equation 26 variable F defined on p. 41 equation C6. Patnaik teaches optimally designing structures having a first solution process and a second solution process. Patnaik further discloses the status variable vector being a displacement in each node – definition of variable X from equation 31, listed at bottom left of p. 40 – and the design

variable vector being rate of existence ration of a structure member in each element – taught in reference as “density”, see derivation of equation 26 on p. 41 equation C6, where F is defined to be a design variable. A design variable vector is the rate of existence in a structure optimization problem as evidence by the Applicant's specification p.18 lines 2-7),

said first solution process comprising:

a design variable update step of reading the design variable vector and the status variable vector stored in a first storage unit, updating the design variable vector, and storing the updated design variable vector into said first storage unit (p. 9 equation 27, p. 6 equations 21a & 21b & col. 2 second paragraph);

a status variable update step of reading the design variable vector and the status variable vector stored in a second storage unit, updating the status variable vector, and storing the updated status variable vector into said second storage unit, said status variable update step including a second solution process to solve an optimization problem of a second evaluation function for the status variable vector and the design variable vector (p. 9 equation 27 & col. 1 lines 2-5 and p. 7 col. 2 section IIIA);

a determination step of determining whether the update in said design variable update step and the update in said status variable update step are to be terminated (p. 2 col. 1 last paragraph and col. 2 first paragraph. In these paragraphs Patnaik teaches iteration and update. This teaching implies the determination of whether the update step is to be terminated); and

an output step of outputting an image of the structure corresponding to the design variable vector and the status variable vector after the updates are terminated (p. 7 col. 2 section A. Interface Module second paragraph and p. 11 Fig. 4. In these paragraphs and figure, Patnaik teaches printing out final results and displaying image of a design, so this

teaching implies the capability of this limitation), and otherwise returning to said design variable step to update the design variable vector (p. 2 col. 1 last paragraph and col. 2 first paragraph. In these paragraphs Patnaik teaches iteration and update. This teaching implies the determination of whether the update step is to be terminated);

but does not teach wherein the second evaluation function corresponds to a norm of a residual vector which is obtained as a difference between a nodal force vector and the status variable vector on which a global stiffness matrix is operated, and said second solution process comprising a conjugate gradient method, and including a preconditioning step of executing preconditioning on a nodal force vector based on a global stiffness matrix

However, Adeli teaches this limitation (col. 18 lines 1-7 & 15-18 & equation 41, col. 16 lines 47-55, col. 24 line 22, and col. 17 lines 3- 10).

It would have been obvious to one of ordinary skill in the art to combine the teachings of Patnaik and Adeli. Adeli's teachings would have adopted the diagonal preconditioner method in order to accelerate the search process in the conjugate gradient method (col. 17 lines 3- 10).

7. As per claim 5, Patnaik teaches at said first solution process an optimality criteria method, method is performed (p. 1 col. 1 paragraph 2 lines 1-5).

8. As per claim 7, the difference between this claim and claim 1 is an information processing apparatus for optimally designing a structure according to the steps recited in claim 1. Patnaik teaches information processing apparatus for optimally designing a structure (CometBoards, p. 10 col. 2 last paragraph lines 1-5).

9. As per claim 8, this limitation has already been discussed in claim 2. It is, therefore, rejected for the same reasons.

10. As per claim 10, the difference between this claim and claim 4 is an information processing apparatus for optimally designing a structure according to the steps recited in claim 4. Patnaik teaches information processing apparatus for optimally designing a structure (CometBoards, p. 10 col. 2 last paragraph lines 1-5).

11. As per claim 11, this limitation has already been discussed in claim 2. It is, therefore, rejected for the same reasons.

12. As per claim 13, the difference between this claim and claim 7 is a program stored in a computer-readable medium to be executed by an information processing apparatus for optimally designing a structure according to the steps recited in claim 1. Patnaik teaches a program stored in a computer-readable medium to be executed by an information processing apparatus (OC code, p. 7 section III paragraph 1).

13. As per claim 14, the difference between this claim and claim 10 is a program stored in a computer-readable medium to be executed by an information processing apparatus for optimally designing a structure according to the steps recited in claim 1. Patnaik teaches a program stored in a computer-readable medium to be executed by an information processing apparatus (OC code, p. 7 section III paragraph 1).

Claims 3 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Patnaik in view of Adeli as applied to claims 1 and 7 above, and further in view of Lingen (A Generalised Conjugate Residual Method for the Solution of Non-Symmetric Systems of Equations with Multiple Right-hand Sides, 1999 John Wiley & Son).

14. As per claim 3, Patnaik and Adeli do not teach at said second solution process, any one of a conjugate residual method, a GCR method, a GCR(k) method, an Orthomin(k) method, a GMRES(k) method and their derivative methods is executed.

    Lingen teaches using an iterative solver for updating variables in structural design by GCR method (p. 642 first paragraph).

    It would have been obvious to one of ordinary skill in the art to combine the teachings of Patnaik, Adeli, and Lingen. Lingen's teachings would have achieved a dual optimizer that uses the iterative GCR method to update the status variable in order to use less memory (p. 641 last paragraph).

15. As per claim 9, this limitation has already been discussed in claim 3. It is, therefore, rejected for the same reasons.

Claims 6 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Patnaik in view of Adeli as applied to claims 1 and 10 above, and further in view of Dickinson et al. (Preconditioned Conjugate Gradient Methods for Three Dimensional Linear Elasticity, Department of Computer Science at the University of Waterloo, 2/9/1993).

16. As per claim 6, Patnaik and Adeli do not teach at said preconditioning step, a component in a row or column of the nodal force vector is set to 0 when a diagonal component in the corresponding row or column of the global stiffness matrix becomes 0.

Dickinson teaches this limitation (p. 7 equations 12 and 15).

It would have been obvious to one of ordinary skill in the art to combine the teachings of Patnaik, Adeli, and Dickinson. Dickinson's teachings would have derived a simpler preconditioner, which is spectrally equivalent to the more complex and original matrix that does not require an exact factorization (p. 8 second paragraph).

17. As per claim 12, this limitation has already been discussed in claim 6. It is, therefore, rejected for the same reasons.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Cuong V. Luu whose telephone number is 571-272-8572. The examiner can normally be reached on Monday-Friday 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini Shah, can be reached on 571-272-2279. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. An inquiry of a general nature or relating to the status of this application should be directed to the TC2100 Group receptionist: 571-272-2100.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Cuong V Luu/

Examiner, Art Unit 2128

/Hugh Jones/

Primary Examiner, Art Unit 2128